

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on December 11, 2008 has been entered.

The supplemental amendment filed January 12, 2009 has been received and entered. With the entry of the amendment, claims 2-3, 5 and 8 are canceled, claim 7 is withdrawn from consideration, and claims 1, 4, 6 and 9-11 are pending for examination.

Election/Restrictions

2. Claim 7 remains withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on October 25, 2007.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The rejection of claims 1, 4 and 6 under 35 U.S.C. 103(a) as being unpatentable over Galasso et al. (patent number 4,425,407, hereafter Galasso '407) in view of Booth et al. (Patent number 5,330,789, hereinafter Booth '789), Holko (U.S. Patent number 5,021,107, hereafter Holko '107) and Hanzawa et al (US 2001/0051258, hereinafter Hanzawa '258) is withdrawn due to the supplemental amendment of January 12, 2009.

5. Claims 1, 6, 9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forsythe et al (US 6555173) in view of Galasso et al (US 4425407), Bauer et al (US 2003/0138672), and optionally, in view of Krenkel et al (US 6358565).

Claim 1: Forsythe teaches a method of making an oxidation protective coating for a carbon/carbon composite. Column 3, lines 1-10. The method includes spraying a mixture comprising a vehicle liquid and Si powder on the carbon/carbon composite and drying the mixture to remove the vehicle liquid. Column 3, lines 5-15 (step (b)), column 3, lines 35-55 and column 6, lines 5-15. Forsythe further teaches heat treating to allow the carbon/carbon composite to be impregnated with the Si. Column 3, lines 10-20 (step (c)), column 3, line 55 through column 4, line 35. The heat treating is performed in a vacuum at a temperature of 1400 to 1600 degrees C, such as 1450 degrees C. Column 3, lines 55-60 and column 6, lines 10-15. It is the Examiner's position that heat

treating in a vacuum would conventionally include pressures of about 10 to about 1000 mTorr. If applicant disagrees, he should so respond on the record in response.

Forsythe does not teach forming an initial coating layer on the carbon/carbon composite by a pack cementation process, but does note the formation of an initial coating layer (column 3, lines 5-15, step (a)). However, Galasso notes that it is well known that when providing SiC layers on carbon-carbon composites, to provide a layer of SiC, for example, by pack cementation before another layer of SiC is provided (by CVD). See Figure 1, column 2, line 55 through column 3, line 10, and column 4, lines 15-30. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Forsythe to provide an initial coating layer by pack cementation as suggested by Galasso with an expectation of desirable treatment results, as Forsythe indicates that initial coating can be provided before the Si powder application and heating, and Galasso teaches that when providing SiC coatings on carbon-carbon composites, it is well known to provide an initial pack cementation coating before another, later SiC coating.

Forsythe does not explicitly teach that the heat treating forms, by thermal diffusion, one SiC layer and one Si layer over the SiC layer as in step (c). (1) However, Forsythe does teach heating spray applied Si powder on a carbon/carbon substrate to impregnate the substrate at the same temperature and in a vacuum understood to be at the pressures equivalent to that required by the present claims to achieve thermal diffusion resulting in an SiC layer and an Si layer over the top (as discussed above), and

therefore, one of ordinary skill in the art would expect the same resulting SiC and Si layer formed by thermal diffusion. (2) Furthermore, the Examiner has provided the optional addition of Krenkel, which indicates that when a layer of silicon powder is provided over a porous carbon layer, and then heated to a temperature of between 1420 and 1650 degrees C, in a vacuum at 10^{-3} to 10^{-6} bar (750 to 0.75 mTorr) (column 3, lines 15-25, column 4, lines 5-40, a resulting thermal diffusion occurs such that a SiC layer (with SiC and Si; the middle layer of particles 3, 5 shown in Figure 1c) is formed with a top Si layer (the top layer of particles 3 shown in Figure 1c) is formed (column 5, lines 15-30). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Forsythe to provide the resulting SiC layer followed by Si layer pattern as suggested by Krenkel when applying the Si powder followed by heating, because Krenkel teaches that when providing Si powder and heating under overlapping conditions, a two part SiC layer followed by Si layer pattern results.

Forsythe further does not teach oxidizing the Si layer to form a SiO_2 film as in step (c). However, Forsythe does teach that optionally a retardant phosphoric acid solution is applied over the top of the coating that can include materials such as $\text{Al}(\text{H}_2\text{PO}_4)_3$ followed by heating. Column 3, lines 15-25 (step (d)), column 4, lines 40-55 and column 6, lines 55-60. Bauer teaches that when providing a carbon fiber reinforced composite, such as a C/C composite which is impregnated with SiC and also has Si material, it is also desired to form an oxidation protection layer with a phosphate containing solution with a material such as $\text{Al}(\text{H}_2\text{PO}_4)_3$ and then heat treat. Paragraphs

[0012], [0015], [0017], and [0023] – [0023]. Bauer further teaches that it is desirable to oxidize the Si in the coating to SiO₂ either during heat treatment of the layer impregnated with Al(H₂PO₄)₃ or prior to this impregnation. Paragraphs [0025] – [0027]. The heating to oxidize can be at 480 degrees C or 800 degrees C, for example. Paragraph [0025]. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Forsythe in view of Galasso (or optionally, Forsythe in view of Galasso and Krenkel) to oxidize the Si layer to form a SiO₂ film as suggested by Bauer to form a desirably protected coating because Forsythe suggests providing a phosphate coating and heating on the Si layer and Bauer teaches that when providing phosphate coatings on SiC/Si containing films it is desirable to oxidize the Si to form SiO₂ before providing the phosphate coating or when heating the phosphate coating, indicating the desire to oxidize Si containing top layers.

Claim 6: Bauer teaches that the heating to oxidize can be at 480 degrees C or 800 degrees C, for example. Paragraph [0025].

Claim 9: Forsythe, Galasso, Bauer and, optionally, Krenkel provide the features of claim 9 as taught with regard to claim 1 above. As to the requirement that the formed Si layer over the SiC layer is exclusively Si, (1) Forsythe would provide such a layer as it provides the same heating step as do present claims 1 and 9, as discussed with regard to claim 1. (2) Furthermore, as to the optional use of Krenkel, Krenkel shows that the top layer is exclusively Si as shown in Figure 1c and column 5, lines 10-30 (the outer coating of silicon 3).

Claim 11: Forsythe, Galasso, Bauer and, optionally, Krenkel provide the features of claim 11 as taught with regard to claim 1 above. As to the requirement that the mixture of vehicle liquid and Si powder to be spray be "consisting essentially of" those materials, the Examiner notes that Forsythe provides that the silicon can be applied as a suspension of elemental silicon powder and that a suspension agent can be used (column 3, lines 35-50), however, even if the mixture of Si powder and vehicle liquid in Forsythe requires the suspending agent, the mixture would still be "consisting essentially of" the Si powder and vehicle liquid; since, as discussed in MPEP 2111.03, "The transitional phrase "consisting essentially of" limits the scope of a claim to the specified materials or steps "and those that do not materially affect the basic and novel characteristic(s)" of the claimed invention. In re Herz, 537 F.2d 549, 551-52, 190 USPQ 461, 463 (CCPA 1976) (emphasis in original)." Here, the described suspension agents would decompose at the heating temperature described for the forming of the SiC and Si layers and therefore not materially affect the resulting coating. Furthermore, as noted also in MPEP 2111.03, "For the purposes of searching for and applying prior art under 35 U.S.C. 102 and 103, absent a clear indication in the specification or claims of what the basic and novel characteristics actually are, "consisting essentially of" will be construed as equivalent to "comprising." See, e.g., PPG, 156 F.3d at 1355, 48 USPQ2d at 1355 ("PPG could have defined the scope of the phrase consisting essentially of' for purposes of its patent by making clear in its specification what it regarded as constituting a material change in the basic and novel characteristics of the invention.")."

6. Claims 4 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forsythe in view of Galasso, Bauer, and, optionally, Krenkel as applied to claims 1, 6, 9 and 11 above, and further in view of Holko (US 5021107).

Forsythe in view of Galasso, Bauer, and, optionally, Krenkel does not specifically provide that the mixture to be sprayed has a vehicle liquid of volatile alcohol (claim 4) or that only Si is left on the composite after applying the mixture (claim 10). Forsythe does teach that the silicon simply is applied as a silicon containing composition (column 3, lines 10-15) that is desirably in suspension form with silicon powder (claim 3, lines 35-45).

However, Holko teaches the well known use of a volatile carrier liquid such as alcohol (column 5, lines 18-19) in a mixture (slurry, which would be a suspension) with powder in order to apply powders of interlayer materials which may be Si (column 3, lines 61-64) by a method such as spraying (column 5, lines 15-25).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Forsythe in view of Galasso, Bauer, and, optionally, Krenkel to provide the suspension of materials to be sprayed simply as a Si powder/alcohol mixture as suggested by Holko with a reasonable expectation of success as Forsythe provides applying a suspension of Si powder, and Holko teaches a desirable suspension for applying by spraying. After the coating and drying of this

suspension only Si powder would remain on the substrate, as Forsythe teaches to remove all volatiles by heating (column 3, lines 50-55).

Double Patenting

7. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

8. Claims 1, 4, 6 and 9-11 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 4 and 6 of copending Application No. 10/767,854 (hereafter '854) in view of Galasso et al. (US 4,425,407).

'854 claims all the features of the current claims except also forming an initial coating layer by pack cementation process. Galasso teaches forming an initial coating

layer [col 2, lines 67-68] on the carbon/carbon composite by a pack cementation process [col 2, lines 64- 67] to improve adhesion. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have formed an initial coating layer by pack cementation on the process of '854 because Galasso teaches that it is a suitable process for a better adhesion.

This is a provisional obviousness-type double patenting rejection.

Response to Arguments

9. Applicant's arguments with respect to claims 1, 4, 6, and 9-11 have been considered but are moot in view of the new ground(s) of rejection.

Applicant's arguments of December 11, 2008 and January 12, 2009 are directed to the rejection under 35 USC 103 using Galasso in view of Booth, Holko and Hanzawa. However, the Examiner notes that this rejection has been withdrawn and a new rejection using Forsythe, Galasso, Bauer and, optionally, Krenkel (and further in view of Holko as to claims 4 and 10).

As to the Declaration of December 11, 2008, this discusses the importance of the temperature range, however, the Examiner notes that Forsythe provides a temperature range of 1400 to 1600 degrees C, with an example of 1450 degrees C, within the claimed range, as discussed in the rejection above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katherine A. Bareford whose telephone number is (571) 272-1413. The examiner can normally be reached on M-F(6:00-3:30) First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy H. Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Katherine A. Bareford/
Primary Examiner, Art Unit 1792